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Examiner: J. Phan

Serial No.: 09/453,327

Filed: December 2, 1999

For: RETROREFLECTIVE ARTICLES
HAVING MICROCUBES, AND TOOLS AND
METHODS FOR FORMING MICROCUBES

I, Anthony J. Montalbano, do declare and state as follows:

1. I am one of the named co-inventors of the above-identified patent application. I am making this declaration in support of the patentability of the invention claimed in this application.

2. In the mid-1940's, I attended trade school. At that school I took courses in mathematics, mechanical drawing, machine shop, design, and mold making.

3. I have been employed by Stimsonite Corporation and its various predecessors-in-interest almost continuously since 1947. I began by serving as a mold making apprentice; eventually I became a tooling supervisor and then a tooling development manager. Most of my tooling expertise was achieved at Stimsonite. Stimsonite Corporation was acquired by Avery Dennison Corporation in about July, 1999, and Avery Dennison has continued the business of

Stimsonite Corporation. I continue to work for Avery Dennison Corporation on a part-time basis. For the sake of simplicity, throughout this Declaration I will refer to the company that has employed me as "Stimsonite," without regard to the time frame of the events discussed herein.

4. Throughout my employment, Stimsonite Corporation was and is in the business of developing, manufacturing, and selling a variety of retroreflective products based on cube corner technology. A "retroreflector" is a reflector that generally reflects light back to the source of the light. A cube corner is a structure formed by three mutually perpendicular faces that intersect one another to form a corner. Incoming light that hits any one of the three faces is reflected to the other two faces and then back in the direction of the source of the light.

5. Over the years, Stimsonite products based on cube corner technology have included bicycle reflectors, automobile taillights, retroreflective strips and other shapes for mounting on the sides of trucks, trains and automobiles, retroreflective buttons for use in the manufacture of highway signs, retroreflective reflectors for use on road barriers, retroreflective lenses for pavement markers, and the like. These products are all based on relatively large (macro) cube corners. About twenty years ago Stimsonite also developed a technique for embossing very small (micro) cube corners onto rolls of flexible plastic sheeting. This retroreflective sheeting is used in the manufacture of highway signs and other safety products.

6. The original tooling for macro-sized cube corner retroreflectors started with 3-foot lengths of metal wire, slightly larger than $\frac{3}{32}$ of an inch in diameter. The wire was drawn to be hexagonal in cross-section, measuring $\frac{3}{32}$ of an inch across the flats. The drawn wire was cut into $1\text{-}\frac{5}{8}$ " lengths to make pins. A cube corner was precisely ground on one end of each

pin, and the three surfaces of the cube corner were highly polished and flat. Groups of such pins were bundled together so that their cube corner tips were all in a desired surface. A 1925 patent to J.C. Stimson, U.S. 1,591,572, attached hereto as Exhibit A, illustrates an early use of a pin bundle to mold cube corner surfaces into molten glass. As the technology advanced, such bundled pins were used to form a mold, which mold could then be used to mass produce plastic retroreflective parts.

7. Throughout my career at Stimsonite I worked on tooling design and development of tooling for cube corner retroreflective products, with particular applications for the highway safety industry. I am a named inventor or co-inventor of several U.S. patents resulting from my work at Stimsonite. These patents relate to the designs of road markers having retroreflective lenses using macro-sized cube corner, and to methods and apparatus for making tools used to emboss micro cube corners into sheeting for products such as retroreflective highway signs. I worked closely with Mr. Paul Deuter, who was the head of the tooling department. Mr. Deuter was responsible for making the pins, assembling them in an appropriate fixture to create a desired configuration of cube corner elements and creating one or more electroforms of the assembled cube corner element configuration. Mr. Deuter would then deliver the electroforms to me. I used the electroforms to create molds for the manufacture of production parts. As part of my responsibilities, I kept abreast of developments in the arts of retroreflective products and tools and methods for their manufacture.

8. At Stimsonite, our standard size for hexagonal macro-sized cube corners was about 3/32 inches across flats. We machined, lapped, and polished cube corners into the ends of the pins, bundled the pins into a desired assembly, and produced molds from the assemblies for

use in the mass production of the various Stimsonite molded plastic reflector products. The size of the pins determined in part the minimum thickness of the ultimate molded plastic reflector product. The molded reflector had to be thick enough to accommodate the height of the cube corners, plus at least 50% more. If we had been able to use smaller cube corner elements, we would have been able to manufacture thinner parts, with corresponding cost savings on the amount of material used. We also would have been able to make flexible retroreflective products.

9. In about the middle to late 1960's a technique was developed by Mr. Kenneth Uding that enabled the use of square pins as small as 0.04 inches across flats, less than half the size of our 3/32 inch hexagonal pins. The 0.04 inch square pins were the lowest practical limit we could obtain using pin technology. Stimsonite used these pins in the 1960's to make reflective plastic strips intended to be mounted to the sides of automobiles and trucks.

10. Attached as Exhibit B is a copy of U.S. Patent No. 4,208,090 ("the Heenan '090 patent"), issued to Sidney A. Heenan and assigned to Amerace Corporation. Amerace Corporation is a predecessor-in-interest of Stimsonite. The Heenan '090 patent states on its face that it issued on June 17, 1980, as a continuation of a parent application originally filed on March 24, 1967.

11. Mr. Heenan, now deceased, was an engineer at Stimsonite for over 50 years. He specialized in cube corner retroreflective technology, and he designed many new cube corner retroreflective products. He was the inventor of the first successful retroreflective cube corner highway marker. Mr. Heenan was a named inventor on many U.S. patents related to road

markers and other cube corner retroreflective products. I worked closely with Mr. Heenan throughout my career at Stimsonite. As part of the responsibilities of my job, I was familiar with most of the products that Mr. Heenan designed, and with the tools and methods used to manufacture those products.

12. I understand that the Heenan '090 patent describes retroreflective products comprising a plurality of hermetically sealed cells with four retroreflective square cube corner elements arranged in a square pattern in each cell. I understand that the retroreflective product illustrated in Figures 1-8 of the Heenan '090 patent is a retroreflective lens for a roadway marker. The Heenan '090 patent states at column 5, lines 64-66 that the major dimension of each of the cells is no greater than about 0.35 inch, and further states at column 7, lines 15-23 that in a "typical construction" the length of each of the cells is 0.08 inches. This corresponds to the width of each square cube corner element being 0.04 inches. This is consistent with my recollection that 0.04 inch square pins were the smallest pins that we could use to make tooling for cube corner elements. I also note that at column 7, lines 9-20 the thickness of the entire lens structure between front face 202 and rear face 203 is stated to be only 0.105 inch.

13. I understand that Figs. 9-12 of the Heenan '090 patent illustrate another embodiment of Mr. Heenan's invention. Beginning at column 8, line 4, this embodiment is described as a retroreflective sheet from which letters can be cut for use in the manufacture of a sign such as a STOP sign. (This "sheet" described in the '090 patent is not the same product as the flexible "sheeting" that Stimsonite developed in the 1980's.) The retroreflective sheet of the '090 patent is also described as having cells, with four square cube corner retroreflector elements in a square configuration in each cell. Because this sheet is to be cut into letters, however, the

sheet is described as being even thinner than the plastic pavement marker lenses illustrated in Figs. 1-8, with a thickness of only 0.025 inches between front face 402 and rear face 403. As a result, the cube corner elements are described as being smaller. At column 10, lines 12-13, the '090 patent states that the length of the side of each cell is 0.04 inch. This means that each cube corner element would be 0.02 inch across flats.

14. I am not aware that Stimsonite ever made a retroreflective sheet product having cube corner and cell dimensions such as are described in column 10 of the Heenan '090 patent, even experimentally. If Stimsonite had made such a product, I would have known about it as part of my responsibility of being familiar with most of Stimsonite's retroreflective products, and the tooling for making those products.

15. I believe that the Heenan '090 patent does not teach one skilled in the tool making arts how to make a retroreflective article having the cube shape, cube dimensions, and other dimensions described in column 10 of the Heenan '090 patent, and I believe it was not possible to make such an article, using pin technology. That is because the 0.040 inch width of the square pins that were used in the reflector structures for the highway marker lenses was the lowest practical limit that we could achieve.

16. I note that the application for the Heenan '090 patent was filed in 1967. I do not know what experimental work, if any, Mr. Heenan intended to describe in columns 8-10 of his '090 patent. I do not know what actual products Mr. Heenan was referring to in columns 8-10 of his patent, nor do I know why that portion of the description was included.

17. The undersigned being hereby warned that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application or any resulting patent, declares that the facts set forth in the declaration are true; all statements made of his own knowledge are true; and all statements made on information and belief are believed to be true.

Further declarant sayeth not.

Anthony J. Montalbano
Anthony J. Montalbano

Date: April 3, 2001